Chemical Engineering Science

List of Contents and Author Index Volume 50, 1995



CHEMICAL ENGINEERING SCIENCE

EDITORS

- PROF. J. BRIDGWATER (EXECUTIVE EDITOR) Department of Chemical Engineering, University of Cambridge, Pembroke Street, Cambridge CB2 3RA, U.K.
- PROF. J. BANDROWSKI Institute of Chemical Engineering and Apparatus Construction, Silesian Technical University, Ul. M Strzody 7, 44-101 Gliwice, Poland
- PROF. A. T. Bell* Department of Chemical Engineering, University of California, Berkeley, CA 94720, U.S.A.
- PROF. R. A. Brown* Department of Chemical Engineering, Massachusetts Institute of Technology, Room 66-342, Cambridge, MA 02139, U.S.A.
- PROF. J.-C. CHARPENTIER CNRS CPE Lyon, BP2077, F-69616 Villeurbanne Cedex, France
- PROF. G. FROMENT Laboratorium voor Petrochemische Techniek, Rijksuniversiteit te Gent, Krijgslaan 271, 9000, Gent, Belgium
- PROF. Dr.-Ing. E. D. Gilles Institut für Systemdynamik und Regelungstechnik, Universität Stuttgart, D-70174 Stuttgart 80, Germany
- PROF. M. KWAUK Institute of Chemical Metallurgy, Beijing, China
- PROF. E. N. LIGHTFOOT (BOOK REVIEW EDITOR) Department of Chemical Engineering, University of Wisconsin, 1415 Johnson Drive, Madison, WI 53706, U.S.A.
- DR R. A. Mashelkar Council of Scientific & Industrial Research, Anusandhan Bhavan, Rafi Marg, New Delhi 110001, India
- PROF. D. M. RUTHVEN* Chemical Engineering Department, University of Maine, Orono, ME 04469-5737, U.S.A.
- PROF. W. P. M. VAN SWAAIJ Department of Chemical Engineering, Twente University of Technology, PO Box 217, 7500 AE Enschede, The Netherlands
- PROF. J. VILLADSEN Instituttet for Bioteknologi, Danmarks Tekniske Hojskole, Bygning 223, 2800 Lyngby, Denmark
- PROF. EMERITUS F. YOSHIDA Department of Chemical Engineering, Kyoto University, Kyoto 606, Japan *See Notes for Contributors.

Publishing, Advertising and Subscriptions Offices

Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K. Tel: (+1865) 843000, Fax: (+1865) 843010, email address: chemistry.production@elsevier.co.uk

Frequency: Published semi-monthly

Subscription Information

Annual Institutional Subscription Rates 1996: North, Central and South America, US\$2537.00, Rest of the World, £1595.00. Sterling prices exclude VAT. Non-VAT registered customers in the European Community will be charged the appropriate VAT in addition to the price listed. Prices include postage and insurance and are subject to change without notice. Subscription enquiries from customers in North America should be sent to: Elsevier Science Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A. and from the Rest of the World to: Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K. Subscription rates for Japan are available on request.

Back Issues: Back issues of all previously published volumes are available direct from Elsevier Science Offices (Oxford and New York). Complete volumes and single issues can be purchased for 1990–1995. Earlier issues are available in high quality photo-duplicated copies as complete volumes only. Back volumes on microfilm are available from UMI, 300 North Zeeb Road, Ann Arbor, MI 48106, U.S.A.

© 1996 Elsevier Science Ltd

SECOND CLASS POSTAGE PAID AT NEWARK, NEW JERSEY AND ADDITIONAL ENTRY POINTS. Chemical Engineering Science (ISSN 0009-2509) is published semi-monthly, two issues per month January to December in one volume, by Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K. The annual subscription in the U.S.A. is \$2537. Chemical Engineering Science is distributed by Virgin Mailing and Distribution, 10 Camptown Road, Irvington, NJ 07111-1105. POSTMASTER: Please send address corrections to Chemical Engineering Science, c/o Elsevier Science Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.

LIST OF CONTENTS

Number 1

- i Editorial
- ii Editors of Chemical Engineering Science 1952-1994
- iii Review articles 1981-1994
- vi Plenary lectures from ISCRE symposia 1980-1994
- viii P. V. Danckwerts memorial lectures 1986-1994
- ix Ninth P. V. Danckwerts memorial lecture-introduction

- R. A. Mashelkar
- S. Ung and M. F. Doherty
- S. S. E. H. Elnashaie, M. E. Abashar and F. A. Teymour
- L. R. Glicksman and T. Yule
- M. M. El-Halwagi, B. K. Srinivas and R. F. Dunn
- Wu Yuan and R. B. Keey
- S. Malik and R. A. Mashelkar
- F. Qin and E. E. Wolf
- D. Chatzopoulos and A. Varma
- I. Machač and Z. Lecjaks
- L. Wang and W. R. Cluett
- L. M. Sun and M. D. Levan

- Ninth P. V. Danckwerts memorial lecture—Seamless chemical engineering science: the emerging paradigm
- 23 Vapor-liquid phase equilibrium in systems with multiple chemical reactions
- 49 Chaotic behaviour of fluidized-bed catalytic reactors with consecutive exothermic chemical reactions
- 69 Prediction of the particle flow conditions in the freeboard of a freely bubbling fluidized bed
- 81 Synthesis of optimal heat-induced separation networks
- 99 Design of staged through-circulation drying with air reversals
- 105 Hydrogen bonding mediated shear stable clusters as drag reducers
- 117 Vibrational control of chaotic self-sustained oscillations during CO oxidation on a Rh-SiO₂ catalyst
- 127 Aqueous-phase adsorption and desorption of toluene in activated carbon fixed beds: experiments and model
- 143 Wall effect for a sphere falling through a non-Newtonian fluid in a rectangular duct
- 149 Building transfer function models from noisy step response data using the Laguerre network

Shorter Communication

Numerical solution of diffusion equations by the finite difference method: efficiency improvement by isovolumetric spatial discretization

- D. N. Jaguste and S. K. Bhatia
- 167 Combined surface and viscous flow of condensable vapor in porous media

T. C. Thulasidas, M. A. Abraham and R. L. Cerro	183	Bubble-train flow in capillaries of circular and square cross section
W. Zhang, F. Johnsson and B. Leckner	201	Fluid-dynamic boundary layers in CFB boilers
L. T. Fan, B. C. Shen and S. T. Chou	211	Stochastic modeling of transient residence-time distributions during start-up
J. Fernández-Sempere, R. Font-Montesinos and O. Espejo-Alcaraz	223	Residence time distribution for unsteady-state systems
Z. Chen, C. Zheng, Y. Feng and H. Hofmann	231	Modeling of three-phase fluidized beds based on local bubble characteristics measurements
J. Zhou, J. R. Grace, C. J. Lim and C. M. H. Brereton	237	Particle velocity profiles in a circulating fluidized bed riser of square cross-section
H. Löfstrand, A. E. Almstedt and S. Andersson	245	Dimensionless expansion model for bubbling fluidized beds with and without internal heat exchanger tubes
J. Weiss, L. Steiner and S. Hartland	255	Determination of actual drop velocities in agitated extraction columns
K. D. Danov, R. Aust, F. Durst and U. Lange	263	Influence of the surface viscosity on the drag and torque coefficients of a solid particle in a thin liquid layer
C. L. Briens, A. Margaritis and G. Wild	279	A new stochastic model and measurement errors in residence time distributions of multiphase reactors
K. D. P. Nigam, A. B. Pandit and K. Niranjan	289	Effect of angle of inclination on liquid-phase controlled mass transfer from a gas slug
Ch. Kersting, J. Prüss and HJ. Warnecke	299	Residence time distribution of a screw-loop reactors experiments and modeling
M. P. Hollewand and L. F. Gladden	309	Transport heterogeneity in porous pellets—I. PGSE NMR studies
M. P. Hollewand and L. F. Gladden	327	Transport heterogeneity in porous pellets—II. NMR imaging studies under transient and steady-state conditions
H. Muhr, R. David, J. Villermaux and P. H. Jezequel	345	Crystallization and precipitation engineering—V Simulation of the precipitation of silver bromide octahedral crystals in a double-jet semi-batch reactor
A. B. Jarzębski and J. Lorenc	357	Pore network connectivity and effective diffusivity of silica aerogels
		Number 3
L. Nilsson and S. Stenström	361	Gas diffusion through sheets of fibrous porous media

L. Nilsson and S. Stenström	361	Gas diffusion through sheets of fibrous porous media
J. M. Hay, B. H. Nelson, C. L. Briens and M. A. Bergougnou	373	The calculation of the characteristics of a chaotic attractor in a gas-solid fluidized bed
J. Bałdyga and J. R. Bourne	381	Interpretation of turbulent mixing using fractals and multifractals
T. N. Haynes, C. Georgakis and H. S. Caram	401	The design of reverse flow reactors for catalytic combustion systems

SW. Chen, CC. Huang and JC. Lin	417	The relationship between the peak shape of a DTA curve and the shape of a phase diagram
O. D. S. Mota and J. B. L. M. Campos	433	Combustion of coke with high ash content in fluidised beds
H. Wu	441	Optimal feed distribution in isothermal fixed-bed reactors for parallel reactions
T. F. McKenna	453	Design model of a wiped film evaporator. Applications to the devolatilisation of polymer melts
J. Espinosa, P. Aguirre and G. Pérez	469	Some aspects in the design of multicomponent reactive distillation columns including nonreactive species
CC. Chen, C. Hwang and R. Y. K. Yang	485	Performance enhancement and optimization of chemostat cascades
M. A. Durán and B. S. White	495	Bayesian estimation applied to effective heat transfer coefficients in a packed bed
C. A. Jaksland, R. Gani and K. M. Lien	511	Separation process design and synthesis based on thermo- dynamic insights
M. Malik and F. Civan	531	A comparative study of differential quadrature and cubature methods vis-à-vis some conventional techniques in context of convection-diffusion-reaction problems
D. D. Do	549	Shorter Communications Dynamics of a semi-batch adsorber with constant molar supply rate: a method for studying adsorption rate of pure gases
Ratoarinoro, F. Contamine, A. M. Wilhelm, J. Berlan and H. Delmas	554	Activation of a solid-liquid chemical reaction by ultra- sound
		Number 4
H. Teng, C. M. Kinoshita and S. M. Masutani	559	Hydrate formation on the surface of a CO ₂ droplet in high-pressure, low-temperature water
G. A. Bunimovich, N. V. Vernikovskaya, V. O. Strots, B. S. Balzhinimaev and Yu. Sh. Matros	565	SO ₂ oxidation in a reverse-flow reactor: influence of a vanadium catalyst dynamic properties
S. E. Olsson, J. Wiman and A. E. Almstedt	581	Hydrodynamics of a pressurized fluidized bed with horizontal tubes: influence of pressure, fluidization velocity and tube-bank geometry
A. W. Nienow, A. Kendall, I. P. T. Moore, G. N. Ozcan-Taskin and R. S. Badham	593	The characteristics of aerated 12- and 18-blade Rushton turbines at transitional Reynolds numbers
K. S. Sorbie, H. R. Zhang and N. B. Tsibuklis	601	Linear viscous fingering: new experimental results, direct simulation and the evaluation of averaged models
S. Isaacs, M. Henze and M. Kümmel	617	An adaptive algorithm for external carbon addition to an alternating activated sludge process for nutrient removal from waste water

List of Contents

F. Raynal and J. N. Gence	631	Efficient stirring in planar, time-periodic laminar flows
Yu. A. Buyevich	641	Interphase interaction in fine suspension flow
A. T. Conlisk	651	Analytical solutions for the heat and mass transfer in a falling film absorber
A. Burghardt and M. Berezowski	661	Stability analysis of steady-state solutions for porous catalytic pellets: influence of the shape of the pellet
B. Legawiec and D. Ziółkowski	673	Mathematical simulation of heat transfer within tubular flow apparatus with packed bed by a model considering system inhomogeneity
HA. Hwang and SM. Chiao	685	Parametric sensitivity of temperature at the regeneration of a single catalyst pellet
J. R. Chen, S. M. Richardson and G. Saville	695	Modelling of two-phase blowdown from pipelines—I. A hyperbolic model based on variational principles
J. C. Pinto and W. H. Ray	715	The dynamic behavior of continuous solution polymerization reactors—VII. Experimental study of a copolymerization reactor
A. Malek, S. Farooq, M. N. Rathor and K. Hidajat	737	Shorter Communication Effect of velocity variation due to adsorption-desorption on equilibrium data from breakthrough experiments
L. H. Ungar	741	Book Reviews Numerical Methods for Problems with Moving Fronts. By B. Finlayson
P. S. Thorne	741	Arsenic in the Environment Part I: Cycling and Characterization. Arsenic in the Environment Part II: Human Health and Ecosystem Effects. Edited by J. O. Nriagu
		Number 5
N. G. Douglas, A. A. Humffray, H. R. C. Pratt and G. W. Stevens	743	Electrophoretic mobilities of proteins and protein mixtures
E. B. Rinker, S. S. Ashour and O. C. Sandall	755	Kinetics and modelling of carbon dioxide absorption into aqueous solutions of N-methyldiethanolamine
W. Kwok, R. E. Hayes and H. A. Nasr-El-Din	769	Modelling dynamic adsorption of an anionic surfactant on Berea sandstone with radial flow
S. Breiter and HG. Lintz	785	Partial oxidation of isobutene to methacrolein on BiW/FeCoMoK mixed oxide catalysts
J. R. Philip	793	Deposition in narrow channels
S. Rajagopalan and J. M. Modak	803	Evaluation of relative growth limitation due to depletion of glucose and oxygen during fungal growth on a spherical solid particle
Kye Soon Hwang, Jae Ho Jun and Won Kook Lee	813	Fixed-bed adsorption for bulk component system. Non-equilibrium, non-isothermal and non-adiabatic model
E. Nagy	827	Three-phase mass transfer: one-dimensional hetero-

L	ist of Contents
837	Reactor performance and validity of steady state and stationary state assumptions in semi-batch free-radical solution polymerisation
849	Aggregation and gelation: III. Numerical classification of kernels and case studies of aggregation and growth
863	Inhibition of gas hydrate formation by means of chemical additives—I. Development of an experimental set-up for characterization of gas hydrate inhibitor efficiency with respect to flow properties and deposition
871	Particle migration at solid surfaces and heat transfer in bubbling fluidized beds—I. Particle migration measurement systems
879	Particle migration at solid surfaces and heat transfer in bubbling fluidized beds—II. Prediction of heat transfer in bubbling fluidized beds
887	Shorter Communications Linear driving force approximation for intraparticle diffusion and convection in permeable supports
890	Pore model for the fibrous collagen matrix in animal skins
897	A corrected tortuosity factor for the network calculation of diffusion coefficients
901	Submerged gas-liquid jets: bubble size prediction
	Number 6
	Number 6
907	Interpretation of transient ultrafiltration and micro- filtration of blood and protein solutions
917	Reduction of the minimum wet thickness in extrusion slot coating
921	Model predictive control of processes with input multiplicities
937	The enhancement of the physical absorption of gases in aqueous activated carbon slurries
943	Synthesis of hippuric acid with inverse phase transfer catalyst in a heterogeneous liquid-liquid reaction system
951	Fractionation of polydisperse dextran using ethanol
959	The use of the kinematic model to predict the development of the stagnant zone boundary in the batch discharge of a bunker
967	Discrete element simulation of granular flow in 2D and 3D hoppers: dependence of discharge rate and wall stress on particle interactions
	837 849 863 871 879 887 890 897 901 907 917 921

Chih-Ta Wang and Shi-Chern Yen 989 Theoretical analysis of film uniformity in spinning processes

V. Balakotaiah, D. Kodra

and D. Nguyen

iii		List of Contents
M. Giona, A. Adrover and A. R. Giona	1001	Convection-diffusion transport in disordered structures numerical analysis based on the exit-time equation
MO. Coppens and G. F. Froment	1013	Diffusion and reaction in a fractal catalyst pore—I Geometrical aspects
MO. Coppens and G. F. Froment	1027	Diffusion and reaction in a fractal catalyst pore—II Diffusion and first-order reaction
J. C. Pinto and W. H. Ray	1041	The dynamic behavior of continuous solution polymerization reactors—VIII. A full bifurcation analysis of a lab-scale copolymerization reactor
A. E. Wraith, Rui-Qing Li and R. Harris	1057	Shorter Communications Gas bubble volume at a narrow slot nozzle in a liquid
C. Nicolella, A. Converti, R. Di Felice and M. Rovatti	1059	The estimation of the solid size and density in liquid fluidised-bed biological reactors
E. Alpay, L. S. Kershenbaum and N. F. Kirkby	1063	Pressure correction in the interpretation of microreactor data
E. N. Lightfoot	1069	Book Reviews Bioprocess Engineering. By B. K. Lydersen, N. A. D'Eliand K. L. Nelson
D. J. Klingenberg	1069	Interfacial Transport Processes and Rheology. By D. A Edwards, H. Brenner and D. T. Wasan
		Number 7
D. P. Hagewiesche, S. S. Ashour, H. A. Al-Ghawas and O. C. Sandall	1071	Absorption of carbon dioxide into aqueous blends of monoethanolamine and N-methyldiethanolamine
J. Ahlbeck, T. Engman, S. Fältén and M. Vihma	1081	Measuring the reactivity of limestone for wet flue-gas desulfurization
A. S. Khare and K. Niranjan	1091	Impeller-agitated aerobic reactor: the influence of ting bubbles on gas hold-up and mass transfer in highly viscous liquids
A. K. Gaigalas, V. Reipa, J. B. Hubbard, J. Edwards and J. Douglas	1107	A non-perturbative relation between the mutual diffusion coefficient, suspension viscosity, and osmotic compressibility: application to concentrated protein solutions
C. Heuer, A. Seidel-Morgenstern and P. Hugo	1115	Experimental investigation and modelling of closed-loop recycling in preparative chromatography
I. Devotta, D. D. Ravetkar, V. D. Ambeskar and R. A. Mashelkar	1129	A new phenomenological model for adsorption-diffusion in polymer solutions: role of disengagement dynamics
E. Flaschel, A. Margot, M. Dohmen and A. Renken	1143	Conversion-space time profiles of stirred tank reactors continuously fed with reactants and catalyst under conditions of strong catalyst deactivation

1149

G. Bryll, Z. Garncarek and J. Boss 1173 An assessment of the state of grain mixture with the use of the method of statistical reduction

Runaway limits for homogeneous and catalytic reactors

- List of Contents 1181 Influence of pH on the oxygen absorption kinetics in F. Camacho, Ma. P. Páez, G. Blázquez, Mª. C. Jiménez alkaline sodium dithionite solutions and M. Fernández A. A. J. Ketelaars, L. Pel, Drying kinetics: a comparison of diffusion coefficients W. J. Coumans and from moisture concentration profiles and drying curves P. J. A. M. Kerkhof N.-E. Sabiri and J. Comiti 1193 Pressure drop in non-Newtonian purely viscous fluid flow through porous media H. M. Kvamsdal and T. Hertzberg 1203 Optimization of pressure swing adsorption systems—the effect of mass transfer during the blowdown step Number 8 R. Di Felice Review Article Number 47. Hydrodynamics of liquid fluidisation
- X. Li and Y. C. Yortsos 1247 Theory of multiple bubble growth in porous media by solute diffusion G. H. Meeten Interpretation of filterability measured by the capillary and J. B. A. F. Smealders suction time method J. Baldyga, W. Podgórska Mixing-precipitation model with application to double 1281 and R. Pohorecki feed semibatch precipitation W.-J. Lu, S.-J. Hwang 1301 Liquid velocity and gas holdup in three-phase internal and C.-M. Chang loop airlift reactors with low-density particles P. J. R. Schreier and P. J. Fryer 1311 Heat exchanger fouling: a model study of the scaleup of laboratory data S. Mankad, C. A. Branch 1323 The effect of particle slip on the sterilisation of and P. J. Fryer solid-liquid food mixtures E. C. Stassinos and H. H. Lee 1337 Kinetics of initial catalyst sintering in supported catalysts K. Schaber

1361

G. Arvind and S. K. Bhatia

1347 Aerosol formation in absorption processes

diffusivities by numerical inversion

Determination of concentration-dependent adsorbate

Y. Wang and W. J. Thomson 1373 The effects of steam and carbon dioxide on calcite decomposition using dynamic X-ray diffraction P. Ayazi Shamlou, S. F. Siddiqi 1383 A physical model of high-pressure disruption of bakers' and N. J. Titchener-Hooker yeast cells J. Alvarez-Ramírez 1393 Observers for a class of continuous tank reactors via temperature measurement S. V. Makarytchev, K. F. Cen, 1401 High-temperature sulphur removal under fluidized bed Z. Y. Luo and X. T. Li combustion conditions—a chemical interpretation

Emulsion polymerization of styrene in a continuous K. Kataoka, N. Ohmura, M. Kouzu, 1409 Y. Simamura and M. Okubo Taylor vortex flow reactor B. D. Crittenden, J. Guan, W. N. Ng Pressure, concentration and temperature profiles in a 5A zeolite adsorbent bed during pressurisation and and W. J. Thomas depressurisation with air Robust controller design for uncertain nonlinear systems Y .- S. Chou and W. Wu via feedback linearization 1441 Diffusion and convective dispersion through arrays of D. A. Edwards and A. M. J. Davis spheres with surface adsorption, diffusion, and unequal solute partitioning The thermal DeNO_x process: influence of partial pressures F. Kasuya, P. Glarborg, J. E. Johnsson and and temperature K. Dam-Johansen Y.-T. Wu and J. M. Nitsche 1467 On diffusion-limited site-specific association processes for spherical and nonspherical molecules A simplified monodimensional approach for modeling J.-F. Cornet, C. G. Dussap, 1489 coupling between radiant light transfer and growth J.-B. Gros, C. Binois and C. Lasseur kinetics in photobioreactors Shorter Communications J. Buzek and M. Jaschik 1501 Equation of Johnstone et al. (1938) to calculate partial pressures of sulphur dioxide over sodium sulphite/ bisulphite solutions—a critical evaluation R. P. Zou and A. B. Yu 1504 The packing of spheres in a cylindrical container: the thickness effect Letters to the Editors Some comments on "The relevance of binodal curve data F. Ruiz and V. Gomis 1509 in ternary liquid-liquid equilibria" S. Brandani Author's reply to comments by F. Ruiz and V. Gomis

1513	Influencing hollow fiber bioreactor hydrodynamics through osmotic pressures—a model study
1519	Identification and control of distributed parameter systems by means of the singular value decomposition
1541	Development of a composition estimator for binary distillation columns. Application to a pilot plant
1551	Denbigh revisited: reducing lost work in chemical processes
1561	Continuous photocatalytic treatment of mercury(II) on titania powders. Kinetics and catalyst activity
1571	Mass transfer in different flow regimes of three-phase fluidized beds
1579	Volumetric mass transfer coefficient in concentric-tube airlift bioreactors
	1519 1541 1551 1561 1571

V. Z. Yakhnin, A. B. Rovinsky	1591	Absolute instability of a tubular packed-bed reactor with
and M. Menzinger		recycling
P. Doron and D. Barnea	1595	Pressure drop and limit deposit velocity for solid-liquid flow in pipes
Y. B. Wang, C. Bisch and F. Teyssandier	1605	Optimization of a wall-less like reactor by simulation
A. L. Burke, T. A. Duever and A. Penlidis	1619	Model discrimination via designed experiments: discrimi- nation between the terminal and penultimate models based on rate data
S. S. E. H. Elnashaie, A. E. Abasaced and S. S. Elshishini	1635	Digital simulation of industrial fluid catalytic cracking units—V. Static and dynamic bifurcation
M. J. W. Frank, J. A. M. Kuipers, G. F. Versteeg and W. P. M. van Swaaij	1645	Modelling of simultaneous mass and heat transfer with chemical reaction using the Maxwell-Stefan theory—I. Model development and isothermal study
M. J. W. Frank, J. A. M. Kuipers, R. Krishna and W. P. M. van Swaaij	1661	Modelling of simultaneous mass and heat transfer with chemical reaction using the Maxwell-Stefan theory—II. Non-isothermal study
C. Hermann, I. Dewes and A. Schumpe	1673	Shorter Communications The estimation of gas solubilities in salt solutions
E. Tronconi and A. Beretta	1676	Inhibition/promotion of a catalytic reaction by the reactant of a simultaneous diffusion-limited reaction
D. W. Slaughter and M. F. Doherty	1679	Number 11 Calculation of solid–liquid equilibrium and crystallization
or in oadginer and in F. Donerry	1012	paths for melt crystallization processes
Y. Samyudia, P. L. Lee, I. T. Cameron and M. Green	1695	A new approach to decentralised control design
W. R. Bowen and F. Jenner	1707	Dynamic ultrafiltration model for charged colloidal dispersions: a Wigner-Seitz cell approach
J. Franke and A. Mersmann	1737	The influence of the operational conditions on the precipitation process
F. Friedler, J. B. Varga and L. T. Fan	1755	Decision-mapping: a tool for consistent and complete decisions in process synthesis
C. M. Corvalán and F. A. Saita	1769	Blade coating on a compressible substrate
S. Vunnum, S. R. Gallant, Y. J. Kim and S. M. Cramer	1785	Immobilized metal affinity chromatography: Modeling of nonlinear multicomponent equilibrium
D. Semino and W. H. Ray	1805	Control of systems described by population balance equations—I. Controllability analysis
D. Semino and W. H. Ray	1825	Control of systems described by population balance equations—II. Emulsion polymerization with constrained control action
Laihong Shen, Mingyao Zhang and Yiqian Xu	1841	Shorter Communication Model for solids mixing in a two-dimensional gas- fluidized bed

E. N. Lightfoot	Book Reviews 1845 Liquid-liquid Extraction Equipment. By J. C. C. and M. J. Slater	odfrey

M. D. Graham		Mathematics			Chemical
	Engineers	s. By R. G. Ri	ce and	D. D. Do	

P. S. Thorne	1846	Patty's Industrial Hygiene and Toxicology,	Vol. 2:
		Toxicology. Edited by G. D. Clayton and F. E	. Clayton

S. Subramanian and V. Balakotaiah	1851	Mode interactions in reaction-driven convection in a porous medium
P. M. Schmidt, R. S. Brown and J. H. T. Luong	1867	Inclusion complexation of tetrathiafulvalene in cyclo- dextrins and bioelectroanalysis of the glucose-glucose oxidase reaction
J. Baldyga, J. R. Bourne and R. V. Gholap	1877	The influence of viscosity on mixing in jet reactors
T. M. Linjewile, V. S. Gururajan and P. K. Agarwal	1881	The CO/CO ₂ product ratio from the combustion of single petroleum coke spheres in an incipiently fluidized bed
P. Daoutidis and P. D. Christofides	1889	Dynamic feedforward/output feedback control of nonlinear processes
J. Yang, P. A. Tanguy and C. Roy	1909	Heat transfer, mass transfer and kinetics study of the vacuum pyrolysis of a large used tire particle
C. M. Hrenya, E. J. Bolio, D. Chakrabarti and J. L. Sinclair	1923	Comparison of low Reynolds number k — ϵ turbulence models in predicting fully developed pipe flow
J. S. Andrade Jr, Y. Shibusa, Y. Arai and C. McGreavy	1943	A network model for diffusion and adsorption in compacted pellets of bidisperse grains
A. Kolker and J. J. de Pablo	1953	Thermodynamic modeling of concentrated multi- component aqueous electrolyte and non-electrolyte solutions
I. Tosun, M. S. Willis, F. Desai and G. G. Chase	1961	Analysis of drag and particulate stress in porous media flows
E. G. Saleeby and H. W. Lee	1971	On the solution of the PBE with agglomeration and random growth rate dispersion
M. Alonso, E. Sainz, F. A. Lopez and K. Shinohara	1983	Void-size probability distribution in random packings of equal-sized spheres
M. Berezowski	1989	Stabilization of unstable steady states of adiabatic tubular reactors with recycle
ZY. Liu and XE. Xu	1997	Heuristic procedure for the synthesis of distillation sequences with multicomponent products
G. Saracco, J. W. Veldsink, G. F. Versteeg and W. P. M. van Swaaij	2005	Catalytic combustion of propane in a membrane reactor with separate feed of reactants—I. Operation in absence of trans-membrane pressure gradients

W. Duo, N. F. Kirkby, J. P. K. Seville and R. Clift	2017	Alteration with reaction progress of the rate limiting step for solid-gas reactions of Ca-compounds with HCl
A. Ghosh-Dastidar, S. Mahuli, R. Agnihotri and LS. Fan	2029	Ultrafast calcination and sintering of Ca(OH) ₂ powder: experimental and modeling
V. Costanza and C. E. Neuman	2041	An adaptive control strategy for nonlinear processes
S. Brandani and D. M. Ruthven	2055	Analysis of ZLC desorption curves for liquid systems
M. Østberg and K. Dam-Johansen	2061	The droplet diffusion model—an empirical model for micromixing in reacting gas phase systems
X. Py, C. Roizard and N. Midoux	2069	Kinetics of sulfur dioxide oxidation in slurries of activated carbon and concentrated sulfuric acid
Z. L. Wang, F. Pla and J. P. Corriou	2081	Nonlinear adaptive control of batch styrene polymerization
M. Millies and D. Mewes	2093	Calculation of circulating flows in bubble columns
M. Millies and D. Mewes	2107	Back-mixing of the continuous phase in bubble columns
R. Font and J. M. López Cabanes	2117	Fermentation in fed-batch reactors—application to the sewage sludge anaerobic digestion
X. Ni, S. Gao, R. H. Cumming and D. W. Pritchard	2127	A comparative study of mass transfer in yeast for a batch pulsed baffled bioreactor and a stirred tank fermenter
KE. Wirth	2137	Heat transfer in circulating fluidized beds
Zumao Chen, Chong Zheng, Yuanding Feng and H. Hofmann	2153	Distributions of flow regimes and phase holdups in three-phase fluidized beds
M. J. San José, M. Olazar, F. J. Peñas, J. M. Arandes and J. Bilbao	2161	Correlation for calculation of the gas dispersion coefficient in conical spouted beds
J. R. Chen, S. M. Richardson and G. Saville	2173	Modelling of two-phase blowdown from pipelines—II. A simplified numerical method for multi-component mixtures
M. Berezowski and A. Burghardt	2189	Shorter Communication Exact uniqueness and multiplicity criteria for a first-order reversible reaction in a CSTR

A. K. Ray and R. W. Carr	2195	Experimental study of a laboratory-scale simulated countercurrent moving bed chromatographic reactor
H. Yoshida and N. Kishimoto	2203	Adsorption of glutamic acid on weakly basic ion exchanger: equilibria
M. R. Mackley and P. Stonestreet	2211	Heat transfer and associated energy dissipation for oscillatory flow in baffled tubes
J. C. Merchuk and I. Berzin	2225	Distribution of energy dissipation in airlift reactors

Xuantian Li, Zhongyang Luo, Mingjiang Ni and Kefa Cen	2235	Modeling sulfur retention in circulating fluidized bed combustors
L. M. Peurrung, M. Rashidi and T. J. Kulp	2243	Measurement of porous medium velocity fields and their volumetric averaging characteristics using particle tracking velocimetry
A. Nakhjavan, P. Björnbom, M. F. M. Zwinkels and S. G. Järås	2255	Numerical analysis of the transient performance of high-temperature monolith catalytic combustors: effect of catalyst porosity
K. Lee, D. K. Boadi and R. J. Neufeld	2263	Steady-state analysis of a fixed bed reactor for urea hydrolysis with microencapsulated urease
P. Mäki-Arvela, T. Salmi and E. Paatero	2275	Kinetics of the chlorination of propanoic acid in the presence of chlorosulphonic acid
Bee-Gim Lim, Chi-Bun Ching, R. B. H. Tan and Siu-Choon Ng	2289	Recovery of (-)-praziquantel from racemic mixtures by continuous chromatography and crystallisation
J. Thullie and A. Burghardt	2299	Simplified procedure for estimating maximum cycling time of flow-reversal reactors
E. Gobina, K. Hou and R. Hughes	2311	Ethane dehydrogenation in a catalytic membrane reactor coupled with a reactive sweep gas
Rong Wang, Zai-Sha Mao and Jiayong Chen	2321	Experimental and theoretical studies of pressure drop hysteresis in trickle bed reactors
S. Banisi, J. A. Finch, A. R. Laplante and M. E. Weber	2329	Effect of solid particles on gas holdup in flotation columns—I. Measurement
S. Banisi, J. A. Finch, A. R. Laplante and M. E. Weber	2335	Effect of solid particles on gas holdup in flotation columns—II. Investigation of mechanisms of gas holdup reduction in presence of solids
J. M. T. Vasconcelos, S. S. Alves and J. M. Barata	2343	Mixing in gas-liquid contactors agitated by multiple turbines
S. S. Alves and J. M. T. Vasconcelos	2355	Shorter Communications Mixing in gas-liquid contactors agitated by multiple turbines in the flooding regime
J. C. R. Turner and J. Webster	2359	Mushroom spores—The analysis of Buller's drop

A. Kienle, G. Lauschke, V. Gehrke and E. D. Gilles	2361	On the dynamics of the circulation loop reactor—numerical methods and analysis
M. H. Al-Dahhan and M. P. Duduković	2377	Catalyst wetting efficiency in trickle-bed reactors at high pressure
Wugeng Liang, Songying Chen and Shaoyi Peng	2391	A model for highly para-selective reactions in HZSM-5 zeolite catalyst
A. Clarke	2397	The application of particle tracking velocimetry and flow visualisation to curtain coating
S. Banerjee, R. Kumar and K. S. Gandhi	2409	Analysis of ultrasonically enhanced hydrogen evolution for Zn-NiCl ₂ system

		List of Contents
H. J. L. Van Can, H. A. B. te Braake, C. Hellinga, A. J. Krijgsman, H. B. Verbruggen, K. Ch. A. M. Luyben and J. J. Heijnen	2419	Design and real time testing of a neural model predictive controller for a nonlinear system
C. B. Elias, R. B. Desai, M. S. Patole, J. B. Joshi and R. A. Mashelkar	2431	Turbulent shear stress—effect on mammalian cell culture and measurement using laser Doppler anemometer
X. S. Wang, M. J. Rhodes and B. M. Gibbs	2441	Influence of temperature on solids flux distribution in a CFB riser
V. G. Doví, L. Acevedo Duarte and L. V. Kafarova	2449	Optimal adjustments of the structure of national chemical productions to technological and economic changes
T. C. Ho, B. Z. Li and J. H. Wu	2459	Estimation of lumped effectiveness factor for many bimolecular reactions
I. P. T. Moore, G. Cossor and M. R. Baker	2467	Velocity distributions in a stirred tank containing a yield stress fluid
H. Böhm and S. Blackburn	2483	Shorter Communications Electro-osmotic cutting of alumina pastes
S. V. Makarytchev, K. F. Cen, Z. Y. Luo and X. T. Li	2489	Catalyzed NO_x formation under fluidized-bed combustion conditions
Zhonglai Wang	2491	Experimental errors due to liquid-phase adsorption in a batch adsorber
M. J. Heslop, G. Mason and A. Provatas	2495	Letters to the Editors Comments on the pressure produced by a soap film meter
M. Barigou and J. F. Davidson	2498	Authors' reply to comments of M. J. Heslop, G. Mason and A. Provatas
M. J. Heslop, G. Mason and A. Provatas	2499	Response of M. J. Heslop, G. Mason and A. Provatas to Authors' reply
M. Barigou and J. F. Davidson	2501	Concluding response of the authors
E. N. Lightfoot	2503	Book Review Two Views of Non-equilibrium Thermodynamics. Part 1, Multicomponent Mass Transfer. By R. Taylor and R. Krishna. Part 2, Thermodynamics of Irreversible Processes. By G. D. C. Kuiken
	2505	Corrigenda
		Number 16
L. J. P. Van Den Broeke and R. Krishna	2507	Experimental verification of the Maxwell-Stefan theory for micropore diffusion
Joong Kee Lee, R. R. Hudgins and P. L. Silveston	2523	A cycled trickle-bed reactor for SO ₂ oxidation
A. S. Burbidge and J. Bridgwater	. 2531	The single screw extrusion of pastes

2545 Three-dimensional transient heat transfer from a buried pipe—III. Comprehensive model

M. A. Hastaoglu, A. Negiz and R. A. Heidemann

I. Devotta, M. V. Badiger, P. R. Rajamohanan, S. Ganapathy and R. A. Mashelkar	2557	Unusual retardation and enhancement in polymer dissolution: role of disengagement dynamics
J. R. Philip	2571	Microscopic analysis and macroscopic models: deposition-dispersion continuum
R. Bilbao, M. U. Alzueta, A. Millera and V. Cantín	2579	Experimental study and modelling of the burnout zone in the natural gas reburning process
D. Kapila and J. L. Plawsky	2589	Diffusion processes for integrated waveguide fabrication in glasses: a solid-state electrochemical approach
L. H. Christensen, U. Schulze,J. Nielsen and J. Villadsen	2601	Acoustic off-gas analyser for bioreactors: precision, accuracy and dynamics of detection
Shih-Yuan Lu and Hway-Chi Lin	2611	Effect of interfacial characteristics on effective conductivities of isotropic two-dimensional periodic composites
F. Y. H. Lin and Dongqing Li	2633	The effect of surface heterogeneity on the drop size dependence of contact angles
W. Rudziński, K. Nieszporek, Hee Moon and Hyun-Ku Rhee	2641	On the theoretical origin and applicability of the potential theory approach to predict mixed-gas adsorption on solid surfaces from single-gas adsorption isotherms
		Shorter Communications
N. Devanathan, M. P. Dudukovic, A. Lapin and A. Lübbert	2661	Chaotic flow in bubble column reactors
Yimin Peng and L. T. Fan	2669	Hysteresis in liquid-solid tapered fluidized beds
E. N. Lightfoot	2673	Book Reviews Physicochemical Hydrodynamics by R. F. Probstein
R. K. Pearson and E. N. Lightfoot	2674	Creative Troubleshooting in The Chemical Process Industries, by David Saletan
	2677	Corrigendum
		Number 17
Y. Zhou and J. J. Derby	2679	The cathode design problem in electrochemical machining
A. Kienle, M. Groebel and E. D. Gilles	2691	Multiple steady states in binary distillation—theoretical and experimental results
G. Groppi, A. Belloli, E. Tronconi and P. Forzatti	2705	A comparison of lumped and distributed models of monolith catalytic combustors
P. J. Jansens, R. van der Ham, O. S. L. Bruinsma, G. M. van Rosmalen and M. Matsuoka	2717	The purification process in hydraulic packed-bed wash columns
L. C. Nitsche and S. Zhuge	2731	Hydrodynamics and selectivity of antipolarization dialysis
J. L. Moreira, P. E. Cruz, P. C. Santana, J. G. Aunins and M. J. T. Carrondo	2747	Formation and disruption of animal cell aggregates in stirred vessels: mechanisms and kinetic studies
S. Békri, J. F. Thovert and P. M. Adler	2765	Dissolution of porous media

S. Kiil, S. K. Bhatia and K. Dam-Johansen	2793	Solution of transient problems with steep gradients: novel front-tracking strategy
H. Wu	2801	An issue on applications of a disk turbine for gas-liquid mass transfer
K. M. Wagialla and S. S. E. H. Elnashaie	2813	Bifurcation and complex dynamics in fixed-bed catalytic reactors
G. Saracco, J. W. Veldsink, G. F. Versteeg and W. P. M. van Swaaij	2833	Catalytic combustion of propane in a membrane reactor with separate feed of reactants—II. Operation in presence of trans-membrane pressure gradients
Total is not the	2843	Corrigendum
	2844	Erratum
		Number 18
J. A. F. Kunst, A. Cybulski, X. Xiaoding and J. A. Moulijn	2845	Estimation of kinetic parameters from non-isothermally operated monolithic reactors: oxidation of carbon monoxide
V. Z. Yakhnin, A. B. Rovinsky and M. Menzinger	2853	Convective instability induced by differential transport in the tubular packed-bed reactor
Chuei-Tin Chang and Jen-Wen Chen	2861	Implementation issues concerning the EKF-based fault diagnosis techniques
K. Wang, T. D. Furney and M. C. Hawley	2883	Modeling the HF adsorption process on wood chips in a packed-bed reactor
Z. Dehouche and J. Lieto	2899	Modelling and experimental study of key parameters of absorption on wetted sphere contactor
C. J. Van Ede, R. Van Houten and A. A. C. M. Beenackers	2911	Enhancement of gas to water mass transfer rates by a dispersed organic phase
M. Ohta, M. Yamamoto and M. Suzuki	2923	Numerical analysis of a single drop formation process under pressure pulse condition
J. Tamim and W. L. H. Hallett	2933	A continuous thermodynamic model for multicomponent droplet vaporization
K. D. Danov, R. Aust, F. Durst and U. Lange	2943	On the slow motion of an interfacial viscous droplet in a thin liquid layer
S. Delcros, JP. E. Grolier, V. Dohnal and D. Fenclová	2957	Infinite-dilution activity coefficients by comparative ebulliometry: measurements and group contribution calculations for some binary mixtures ether $+ n$ -alkane and ether $+$ alcohol
B. B. Breman, A. A. C. M. Beenackers and M. J. Bouma	2963	Flow regimes, gas hold-up and axial gas mixing in the gas-liquid multi-stage agitated contactor
A. B. M. Heesink and W. P. M. van Swaaij	2983	The sulphidation of calcined limestone with hydrogen sulphide and carbonyl sulphide
K. Y. Prasad and T. K. Ramanujam	2997	Shorter Communications Enhancement of gas-liquid mass transfer in a modified reversed flow jet loop reactor with three-phase system
M. Hacimusalar and Ü. Mehmetoğlu	3001	Determination of the effective diffusion coefficients of glucose and ethanol in calcium alginate gel by the moment analysis method

List of Contents

R. Di Felice, L. G. Gibilaro and P. U. Foscolo	3005	On the hindered settling velocity of spheres in the inertial flow regime
E. N. Lightfoot	3007	Book Review Principles of Enhanced Heat Transfer by R. L. Webb
		Number 19
O. Pamperin and HJ. Rath	3009	Influence of buoyancy on bubble formation at submerged orifices
N. Funamizu and T. Takakuwa	3025	An improved Richardson-Zaki formula for computing mixed layer composition in binary solid-liquid fluidized beds
A. K. Ray and R. W. Carr	3033	Numerical simulation of a simulated countercurrent moving bed chromatographic reactor
J. N. Papageorgiou and G. F. Froment	3043	Simulation models accounting for radial voidage profiles in fixed-bed reactors
V. I. Sikavitsas and R. T. Yang	3057	Predicting multicomponent diffusivities for diffusion on surfaces and in molecular sieves with energy heterogeneity
J. Buzek and M. Jaschik	3067	Gas-liquid equilibria in the system SO_2 -aqueous solutions of $NaHSO_3/Na_2SO_3/Na_2SO_4$
Wei Ji and F. Setterwall	3077	Effect of heat transfer additives on the instabilities of an absorbing falling film
P. S. Stewart and J. B. Raquepas	3099	Implications of reaction-diffusion theory for the disinfection of microbial biofilms by reactive antimicrobial agents
R. K. Tyagi, A. E. Fouda and T. Matsuura	3105	A pervaporation model: membrane design
D. O. Borio, V. Bucala and J. A. Porras	3115	Thermal regimes in cocurrently cooled fixed-bed reactors
S. Shvartsman and M. Sheintuch	3125	One- and two-dimensional spatiotemporal thermal patterns in a fixed-bed reactor
T. M. Verghese and R. M. Nedderman	3143	The discharge of fine sands from conical hoppers
Y. A. Buyevich, J. G. Yates, D. J. Cheesman and KT. Wu	3155	A model for the distribution of voidage around bubbles in a fluidized bed
		Number 20
J. G. Sczechowski, C. A. Koval and R. D. Noble	3163	A Taylor vortex reactor for heterogeneous photocatalysis
J. B. Snape, J. Zahradník, M. Fialová and N. H. Thomas	3175	Liquid-phase properties and sparger design effects in an external-loop airlift reactor
P. D. Hammond and J. R. G. Evans	3187	Thermolytic debinding of ceramic mouldings using over- pressure
S. Ung and M. F. Doherty	3201	Theory of phase equilibria in multireaction systems
S. S. Nivarthi, H. T. Davis and A. V. McCormick	3217	Effectiveness of window blocking in zeolite NaY by strongly coadsorbed molecules

	*	X
S. E. Olsson and A. E. Almstedt	3231	Local instantaneous and time-averaged heat transfer in a pressurized fluidized bed with horizontal tubes: influence of pressure, fluidization velocity and tube-bank geometry
P. S. Hammond	3247	Settling and slumping in a Newtonian slurry, and implications for proppant placement during hydraulic fracturing of gas wells
M. J. Miller and H. S. Fogler	3261	Prediction fluid distribution in porous media treated with foamed gel
S. Gupta, D. L. Feke and I. Manas-Zloczower	3275	Fractionation of mixed particulate solids according to compressibility using ultrasonic standing wave fields
Lj. Kundakovic and G. Vunjak-Novakovic	3285	Mechanics of particle motion in three-phase flow
Zong Ding Hu and Ying Jin Yuan	3297	Fuzzy growth kinetics of immobilized C. Roseus cells in polyurethane foams
C. Vergel, J. P. Euzen, P. Trambouze and J. P. Wauquier	3303	Two-phase flow catalytic reactor, influence of hydro- dynamics on selectivity
V. N. Burganos, F. A. Coutelieris, G. Dassios and A. C. Payatakes	3313	Shorter Communications On the rapid convergence of the analytical solution of Stokes flow around spheroids-in-cell
R. T. Yang and V. I. Sikavitsas	3319	Kinetic theory for predicting multicomponent diffusivities from pure-component diffusivities for surface diffusion and diffusion in molecular sieves
I. Machaë, I. Ulbrichova, T. P. Elson and D. J. Cheesman	3323	Fall of spherical particles through non-Newtonian suspensions
M. J. J. Mayer, J. Meuldijk and D. Thoenes	3329	High conversion emulsion polymerization in large scale reactors
	3331	Announcement
		Number 21
R. Wu, M. J. McCready and A. Varma	3333	Influence of mass transfer coefficient fluctuation frequency on performance of three-phase packed-bed reactors
J. Wiman, B. Mahpour and A. E. Almstedt	3345	Erosion of horizontal tubes in a pressurized fluidized bed—influence of pressure, fluidization velocity and tube- bank geometry
M. R. Riley, F. J. Muzzio and H. M. Buettner	3327	The effect of structure on diffusion and reaction in immobilized cell systems
M. Łabęcki, J. M. Piret and B. D. Bowen	3339	Two-dimensional analysis of fluid flow in hollow-fibre modules
G. Saracco and V. Specchia	3385	Studies on sol-gel derived catalytic filters
H. J. Keh and S. H. Chen	3395	Particle interactions in thermophoresis
D. E. Rosner and P. Tandon	3409	Rational prediction of inertially induced particle deposition rates for a cylindrical target in a dust-laden stream
T. D. Papathanasiou	3433	Modelling of injection mold filling: effect of undercooling on polymer crystallization

3443	Gas-solids flow in the riser of a circulating fluidized bed
3455	The dynamic behavior of continuous solution polymeriz- ation reactors—a full bifurcation analysis of a full scale copolymerization reactor
3477	Solvent and salt effects on the formation of third liquid phase and the reaction mechanisms in the phase transfer catalysis system—reaction between N-butyl bromide and sodium phenolate
3487	Shorter Communications Effect of binary cross-term diffusivities in molecular sieve on adsorber dynamics
3493	Simulation of the growth of CVD films
3499	Erratum
	Number 22
3501	The interpretation of flotation froth surfaces by using digital image analysis and neural networks
3515	Group-contribution estimation of critical temperature with only chemical structure
3521	On doubly diffusive Marangoni convection
3525	Measurement of solids concentration in aqueous slurries using a microwave technique
3535	Thermodynamics of hydrogen-bonded polymer gel-solvent systems
3547	Removal of dissolved oxygen in ultrapure water production using a membrane reactor
3557	Mechanistic modelling of fluid permeation through compressible fiber beds
3573	Analysis of mass and heat transfer in transient experiments over heterogeneous catalysts
3581	Drop breakup by impellers
3587	Kinetics of absorption of CO ₂ into aqueous solutions of 2-amino-2-methyl-1-propanol
3599	Identification of Hammerstein models using multivariate statistical tools
3615	Silicon deposition from silane or disilane in a fluidized bed—Part I: experimental study
3625	Silicon deposition from silane or disilane in a fluidized bed—Part II: theoretical analysis and modeling
3637	The effect of micromixing on steady-state multiplicity for autocatalytic reactions in a nonideal mixing of CSTR
3645	Steady-state multiplicity for autocatalytic reactions in a non-ideal mixing of CSTR with two unpremixed feeds
	3455 3477 3487 3493 3499 3501 3515 3521 3525 3535 3547 3557 3573 3581 3587 3587 3625 3625 3637

A. B. M. Heesink and W. P. M. Van Swaaij	3651	Shorter Communications The adsorption of H ₂ S on sulphided limestone				
G. Zoia and W. Strieder	3657	Structure independent reciprocal bounds on cell wall permeabilities				
	Number 23					
	iii	Tenth P. V. Danckwerts memorial lecture—introduction				
	iv					
	v	THE COUNTY OF THE PARTY OF THE				
J. F. Davidson	3661	remained 1100 as a street of 1 G				
D. Tsamatsoulis and N. Papayannakos	3685	Simulation of non-ideal flow in a trickle bed hydrotreater by the cross-flow model				
A. Kalafatis, N. Arifin, L. Wang and W. R. Cluett	3693	A new approach to the identification of pH processes based on the Wiener model				
E. N. Kaufman, J. N. Petersen, Y. Wang and M. H. Little	3703	Experimental and numerical characterization of liquid fluidized beds of coal particles				
Chunsheng Fu and Manel Poch	3715	Fuzzy modeling and pattern recognition for dynamic processes and its application for an activated sludge process				
E. P. L. Roberts and M. R. Mackley	3727	The simulation of stretch rates for the quantitative prediction and mapping of mixing within a channel flow				
C. W. Smith, K. S. Narendra and M. A. Gevelber	3747	Modelling for control of induction plasma deposition				
Lj. Kundakovic and G. Vunjak-Novakovic	3763	A fluid dynamic model of the draft tube gas-liquid-solid fluidized bed				
M. A. Koenders and R. J. Wakeman	3777	Radial flow dependence in filtration experiments				
A. R. Kovscek, T. W. Patzek and C. J. Radke	3783	A mechanistic population balance model for transient and steady-state foam flow in Boise sandstone				
S. S. Au, J. S. Dranoff and J. B. Butt	3801	Nonuniform activity distribution in catalyst particles: benzene hydrogenation on supported nickel in a single pellet diffusion reactor				
J. D. Brotherton and P. C. Chau	3813	Analysis of convective flow effects on the performance of an intercalated-spiral alternate-dead-ended hollow fiber bioreactor				
O. Paladino, M. Ratto and P. Costa	3829	Shorter Communications Chaos and chemical reactor models: sensitivity of dynamics on parameters uncertainty				
A. J. Varma, A. K. Lele and R. A. Mashelkar	3835	Separations based on chemically selective polymer gels				
B. D. Crittenden, R. W. Field and M. I. Pervez	3839	Oscillatory flow in packed beds and baffled tubes. A unifying approach to the interpretation of experimental data				
	384	7 Corrigendum				

SPECIAL ISSUE

FRONTIERS OF CHEMICAL ENGINEERING SCIENCE

J. Bridgwater	3849	Foreword
	3851	Chemical Engineering Science—Editors 1952-1995
P. V. Donaharata	2066	Part A: Reprints of "Classic" Articles from Chemical Engineering Science
P. V. Danckwerts	3855	Continuous flow systems. Distribution of residence times
J. J. van Deemter, F. J. Zuiderweg and A. Klinkenberg	3867	Longitudinal diffusion and resistance to mass transfer as causes of monideality in chromatography
J. F. Wehner and R. H. Wilhelm	3883	Boundary conditions of flow reactor
O. Levenspiel and W. K. Smith	3889	Notes on the diffusion-type model for the longitudinal mixing of fluids in flow
R. Aris	3897	On shape factors for irregular particles—I. The steady- state problem. Diffusion and reaction
L. E. Scriven	3905	On the dynamics of phase growth
P. H. Calderbank and M. B. Moo-Young	3919	The continuous phase heat and mass transfer properties of dispersions
H. Brenner	3935	The diffusion model of longitudinal mixing in beds of finite length. Numerical values
P. B. Weisz and J. S. Hicks	3949	The behaviour of porous catalyst particles in view of internal mass and heat diffusion effects
K. R. Westerterp, L. L. van Dierendonck and J. A. de Kraa	3959	Interfacial areas in agitated gas-liquid contactors
J. V. Villadsen and W. E. Stewart	3979	Solution of boundary-value problems by orthogonal collocation
	3997	Frontiers of Chemical Engineering Science
B. Brown and R. Mashelkar	4001	Part B: Symposium Proceedings Introduction
1. G. Kevrekidis	4005	Matrices are forever: on applied mathematics and computing in chemical engineering
R. A. van Santen	4027	Catalysis: closing the molecular and macroscopic sciences gap
J. Ponton	4045	Process Systems Engineering: halfway through the first century
J. R. Rostrup-Nielsen	4061	Innovation and the catalytic process industry—the science and the challenge
C. F. Zukoski	4073	Particles and suspensions in chemical engineering: accomplishments and prospects

- J. Bridgwater
- J. E. Bailey
- R. Langer
- M. Tirrell

- 4081 Particle technology
- 4091 Chemical engineering of cellular processes
- 4109 Biomaterials and biomedical engineering
- 4123 Chemical engineering of polymers: production of flexible, functional materials